

12U Biochemistry Unit Test

Modified True/False

Indicate whether the statement is true or false. If false, change the identified word or phrase to make the statement true.

- _____ 1. The amount of energy needed to strain and break the reactants' bonds in a biochemical reaction is called the *transition energy*. _____

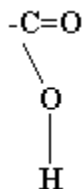
Multiple Choice

Identify the choice that best completes the statement or answers the question.

- _____ 2. Which of the following compounds is a component of cell membranes?
a. nucleic acids c. proteins
b. cellulose d. water
- _____ 3. The cell membrane is best described as
a. impermeable. c. permeable.
b. selectively permeable. d. opaque.
- _____ 4. The cytoplasm is the site of
a. chemical reactions. d. transport of nutrients.
b. nutrient processing. e. all of the above.
c. storage of wastes.
- _____ 5. The organelle responsible for storage and packaging of proteins is the
a. nucleus. d. vesicle.
b. ribosome. e. Golgi apparatus.
c. endoplasmic reticulum.
- _____ 6. Which of the following is the essential characteristic of a polar molecule?
a. contains double or triple bonds
b. is formed at extremely low temperatures
c. contains ions as part of the structure
d. has an asymmetrical distribution of electrical charge
e. contains the element oxygen
- _____ 7. Isomers are molecules that
a. react readily with one another
b. have the same molecular formula
c. have different molecular masses
d. differ in the number of unsaturated bonds
e. must contain the same functional group
- _____ 8. In living organisms, buffers do which of the following?
a. prevent charged particles from entering cells
b. neutralize the effect of enzymes
c. maintain pH in the cells within a narrow range, allowing enzymes to function
d. allow the pH of cells to change without affecting the action of the enzymes
e. maintain cytoplasm in a fluid condition

9. Which three of the following are characteristics of hydrogen bonds?
- They are responsible for the surface tension properties of water.
 - They are responsible for the relatively high boiling point of water.
 - They are stronger than ionic bonds.
 - They are present in all substances.
 - They are weaker than covalent bonds.
- III, IV and V
 - I, II and V
 - I, III and IV
 - II, III and IV
 - I, III, and IV

10. The following structural formula is representative of which functional group?



- sulfhydryl
- hydroxyl
- carbonyl
- carboxyl
- amino

11. Which of the functional groups illustrated below would you expect to find in an amino acid?

1	2	3	4	5
$\begin{array}{c} \\ \text{C=O} \\ \\ \text{O} \\ \\ \text{H} \end{array}$	$\begin{array}{c} \\ \text{C=O} \\ \\ \text{H} \end{array}$	$\begin{array}{c} \\ \text{-C-OH} \\ \end{array}$	$\begin{array}{c} \text{H} \\ \\ \text{-N} \\ \\ \text{H} \end{array}$	$\begin{array}{c} \\ \text{C=O} \\ \end{array}$

- 1, 2, and 4
- 2, and 3
- 2, 4, and 5
- 1 and 4
- 3 and 5

12. Of the following, which is not considered to be a polymer?

- cellulose
- RNA
- starch
- protein
- fat

13. From the following list, which is an example of a monosaccharide?

- maltose
- glycogen
- cellulose
- glucose
- sucrose

14. When a molecule of glycerol reacts with one or more fatty acids an ester linkage results. The formation of this linkage is a result of a reaction between

- an amino acid and a carboxylic acid
- two alcohols
- an alcohol and a carboxylic acid
- two carboxylic acids
- two amino acids

- _____ 15. When two organic molecules are joined together and a water molecule is removed, the reaction is called which of the following?
- a. dehydration synthesis (condensation)
 - b. hydrogenation
 - c. hydrolysis
 - d. oxidation
 - e. reduction
- _____ 16. The extremely large diversity of structure seen in proteins is mainly due to
- a. the disulfide and hydrogen bonds that determine molecular shape
 - b. the action of the ribosomes
 - c. the precise location of specific amino acids, common to all proteins
 - d. different numbers, kinds, and sequences of amino acids
 - e. different kinds of bonds between successive amino acids
- _____ 17. An oxidation/reduction is best shown by which of the following?
- a. an amino and carboxyl group form a peptide bond
 - b. two small molecules chemically combine to form a large one
 - c. a base reacts with an acid to form water and a salt
 - d. electrons are transferred from one substance to another
 - e. a large molecule is broken into two smaller molecules
- _____ 18. Of the following five statements, which is most correct with respect to enzymes?
- a. A denatured enzyme is more specific in its action.
 - b. Denaturation of proteins always involves enzymes.
 - c. Catalysts prevent chemical reactions.
 - d. All catalysts are enzymes.
 - e. All enzymes are catalysts.
- _____ 19. Which of the following statements about enzymes is **not** true?
- a. They are proteins with tertiary or quaternary structures.
 - b. They are very specific for the substrate to which they bind.
 - c. They will bind their substrate and any isomer of their substrate.
 - d. Their names usually end in 'ase.'
 - e. All of the above statements are true.
- _____ 20. Which of the following statements concerning allosteric regulation is not true?
- a. Allosteric sites are usually located next to, but separate from, the active site.
 - b. Allosterically controlled enzymes usually have quaternary structure.
 - c. 'Activators' tend to keep all the active sites available to the normal substrate.
 - d. 'Allosteric inhibitors' stabilize the inactive form of the enzyme.
 - e. Allosteric regulators attach to their sites using weak bonds.

Matching

Match each item with the correct statement below. [4]

- a. London dispersion
- b. polar covalent bonds and symmetrical structure
- c. intermolecular
- d. hydrophobic
- e. van der Waals forces
- f. hydrogen bond
- g. polar covalent bonds and asymmetrical structure
- h. intramolecular
- i. hydrophilic
- j. dipole-dipole

- ___ 21. What makes water a highly polar molecule?
- ___ 22. What are bonds between molecules called?
- ___ 23. What is the only force of attraction between noble gases?
- ___ 24. What force is responsible for holding polar molecules to one another?
- ___ 25. What dipole-dipole force results between H and either N, O or F?
- ___ 26. What is the collective name for intermolecular bonding?
- ___ 27. What is a property of nonpolar molecules?
- ___ 28. What is a property of polar molecules?

Making Connections: 14 marks

29. Construct a table to summarize the four major types of biochemical reactions studied in this course. For each type give the name, a word summary of what happens during the reaction, and an example of where the reaction might be biologically important. [T/I: 4]

Type of Reaction	Word Summary	Example

30. Examine the following data that are related to a variety of enzymes, which have been tested at a number of temperatures and pH levels to measure their activities [A: 6]

Enzyme Activity (mmol/ug of enzyme protein/min) for **Enzyme 'A'**

	T=4°C	T=20°C	T=37°C	T=45°C	T=80°C
pH=1	0	0	0	0	0
pH=4	0	2	10	2	0
pH=7	0	5	50	5	0
pH=10	0	2	10	2	0
pH=13	0	0	0	0	0

Enzyme Activity (mmol/ug of enzyme protein/min) for **Enzyme 'B'**

	T=4°C	T=20°C	T=37°C	T=45°C	T=80°C
pH=1	0	2	10	2	0
pH=4	0	2	10	2	0
pH=7	0	2	10	2	0
pH=10	0	2	10	2	0
pH=13	0	2	10	2	0

Enzyme Activity (mmol/ug of enzyme protein/min) for **Enzyme 'C'**

	T=4°C	T=20°C	T=37°C	T=45°C	T=80°C
pH=1	0	0	0	0	0
pH=4	2	2	2	2	2
pH=7	10	10	10	10	10
pH=10	2	2	2	2	2
pH=13	0	0	0	0	0

Complete the following table based on these results.

Enzyme	Optimal Temperature	Optimal pH
A		
B		
C		

31. In hospitals, medication is often delivered in an IV (intravenous) solution that is isotonic to the blood. Explain why distilled water cannot be used as the carrier solution. [T/I: 4]

Communication: 12 marks

32. List two sterols other than cholesterol and describe a function for each. [C:4]

33. Define quaternary structure. Provide two examples of proteins that are only functional in quaternary structure. [C: 3]

34. The cell membrane is said to be selectively permeable. Explain what is meant by this term. [C: 1]

35. Explain what 'feedback inhibition' is and how it would work in a cell. [C: 4]

12U Biochemistry Test Answer Section

MODIFIED TRUE/FALSE

1. ANS: F, activation energy

PTS: 1

REF: K/U

MULTIPLE CHOICE

- | | | |
|------------|--------|----------|
| 2. ANS: C | PTS: 1 | REF: K/U |
| 3. ANS: B | PTS: 1 | REF: K/U |
| 4. ANS: E | PTS: 1 | REF: K/U |
| 5. ANS: E | PTS: 1 | REF: K/U |
| 6. ANS: D | PTS: 1 | REF: K/U |
| 7. ANS: B | PTS: 1 | REF: K/U |
| 8. ANS: C | PTS: 1 | REF: K/U |
| 9. ANS: B | PTS: 1 | REF: K/U |
| 10. ANS: D | PTS: 1 | REF: A |
| 11. ANS: D | PTS: 1 | REF: A |
| 12. ANS: E | PTS: 1 | REF: K/U |
| 13. ANS: D | PTS: 1 | REF: K/U |
| 14. ANS: C | PTS: 1 | REF: K/U |
| 15. ANS: A | PTS: 1 | REF: K/U |
| 16. ANS: D | PTS: 1 | REF: K/U |
| 17. ANS: D | PTS: 1 | REF: K/U |
| 18. ANS: E | PTS: 1 | REF: K/U |
| 19. ANS: C | PTS: 1 | REF: K/U |
| 20. ANS: A | PTS: 1 | REF: K/U |

MATCHING

- | | | |
|------------|----------|----------|
| 21. ANS: G | PTS: 0.5 | REF: K/U |
| 22. ANS: C | PTS: 0.5 | REF: K/U |
| 23. ANS: A | PTS: 0.5 | REF: K/U |
| 24. ANS: J | PTS: 0.5 | REF: K/U |
| 25. ANS: F | PTS: 0.5 | REF: K/U |
| 26. ANS: E | PTS: 0.5 | REF: K/U |
| 27. ANS: D | PTS: 0.5 | REF: K/U |
| 28. ANS: I | PTS: 0.5 | REF: K/U |

SHORT ANSWER

29. ANS:

Name Of Reaction	Summary Of Changes	Example
dehydration synthesis (condensation)	two molecules joined; water removed from the point where the molecule join	synthesis of macromolecules for storage of energy or information
hydrolysis	large molecule split into two smaller ones; water added at the point where the molecules split	digestion: breakdown to smaller molecules of fewer kinds for active transport
redox	hydrogen atoms or electrons transferred between reactants	energy storage and transfer in cells
neutralization	acid + base \rightarrow water and salt	stomach acid neutralized by bile and sodium bicarbonate in pancreatic juice in the duodenum

PTS: 4

REF: T/I

30. ANS:

Enzyme	Optimal Temperature	Optimal pH
A	37	7
B	37	doesn't matter
C	doesn't matter	7

PTS: 6

REF: A

31. ANS:

- Distilled water is water with no dissolved salts and minerals, which are very important for normal physiological functions
- The fluid in an IV solution is far from distilled water because it must contain dissolved salts at the same percentage as in the blood – isotonic
- Isotonic solution: a solution that has the same salt concentration as the normal cells of the body and the blood

PTS: 4

REF: T/I

32. ANS: Any two of:

- Progesterone, estradiol and testosterone – sex hormones that control the development of sex traits and gametes
- Cortisol – a hormone released in response to stress: increases blood sugar, suppresses immune system, aids in metabolism
- Phytosterol – plant sterols, similar to cholesterol – are present in many foods, and can aid in lowering human cholesterol levels.

PTS: 4

REF: C

33. ANS:

- Quaternary structure: the arrangement of multiple folded protein or coiling protein molecules in a multi-subunit complex
- Examples: hemoglobin, DNA polymerase, catalase

PTS: 3 REF: C

34. ANS:

It allows some materials to pass through while preventing others from passing.

PTS: 1 REF: C

35. ANS:

- Feedback inhibition is a method of metabolic control in which a produce formed later in a sequence of reactions allosterically inhibits an enzyme that catalyzes a reaction occurring earlier in the process.
- In an imaginary pathway such as that shown below, it is possible that 'F' may be a chemical that allosterically inhibits the conversion of 'C' into 'D'.
- This would mean that when 'F' is not in high demand in the cell it would then serve to shut down its own formation and prevent the cell from wasting energy in making more of it.
- In times when 'F' is in high demand enough of it would not be around to inhibit the pathway and so its production would continue uninhibited.

A->B->C->D->E->F->G->H

PTS: 4 REF: C

Test Qs #	Qs Type	Coded Ministry Expectation	Marks	Achievement Chart Category			
				Knowledge and Understanding	Thinking and Investigation	Communication	Application
1	True/False	B2.1	1	X			
2	MC	B3.6	1	X			
3	MC	B2.2/B3.6	1	X			
4	MC	B3.1	1	X			
5	MC	B3.1	1	X			
6	MC	B2.1/B3.3	1	X			
7	MC	B3.2	1	X			
8	MC	B3.4	1	X			
9	MC	B2.1	1	X			
10	MC (with Structural Diagram)	B2.3/B3.3	1				X
11	MC (with Structural Diagram)	B2.3/B3.3	1				X
12	MC	B3.2	1	X			
13	MC	B3.2	1	X			
14	MC	B3.3	1	X			
15	MC	B3.5	1	X			
16	MC	B3.2	1	X			
17	MC	B3.5	1	X			
18	MC	B3.4	1	X			
19	MC	B3.2/B3.4	1	X			
20	MC	B2.1/B3.4	1	X			
21	Matching	B2.1	0.5	X			
22	Matching	B2.1	0.5	X			
23	Matching	B2.1	0.5	X			
24	Matching	B2.1	0.5	X			
25	Matching	B2.1	0.5	X			
26	Matching	B2.1	0.5	X			
27	Matching	B2.1/B3.6	0.5	X			
28	Matching	B2.1/B3.6	0.5	X			
29	Short Answer	B3.5	4		X		
30	Data Analysis	B2.5/B3.4	6				X
31	Short Answer	B1.2/B2.1/B2.2/B3.6	4		X		
32	Short Answer	B3.2	4			X	
33	Short Answer	B2.3/B3.2	3			X	
34	Short Answer	B3.6	1			X	
35	Diagram	B2.1/B3.4	4			X	
Totals (/50)				K/U: 22	T/I: 8	C: 12	A:8

